

***Klamath Network Inventory and Monitoring Program
2004 End of Season Report for Bat Inventories***

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Title: Distribution and relative abundance of bat species in Crater Lake National Park, Redwood National and State Parks, and Oregon Caves National Monument.

Executive Summary: During the summer of 2004, between 8 August and 13 October, I conducted bat inventories in three of the Klamath Network (KLMN) parks: Crater Lake National Park (CRLA), Oregon Caves National Monument (ORCA), and Redwood National and State Parks (RNSP). This inventory was designed to provide KLMN with a baseline dataset for bats fundamental in developing future monitoring efforts. Bats were documented using three methods, mist nets, harp traps, and Anabat II acoustical detectors. Using live capture techniques, 5 species were documented in CRLA, 4 species in ORCA, and 8 species in RNSP, resulting in grand total of 90 captures representing 11 species. In addition to the live captures, I recorded 6,152 Anabat II sequence files during echolocation surveys. At ORCA, I examined the effects of obstruction on several cave openings, and determined that gate installation would not significantly affect bat activity at these cave openings. During the course of this survey, no new species were documented that were not already listed on uncertified park species lists, but I did confirm the presence of 11 species in KLMN for these lists. Survey effort (5,231 m² net hours) during this field season is only about 10% of that conducted for Lassen Volcanic National Park and Whiskeytown National Recreation Area during equivalent surveys 2001-2003. These results should be interpreted carefully until additional data for CRLA and RNSP is available from subsequent field seasons, at which point sample sizes may be adequate to draw management implications.

Background and Problem Statement: Because of their distinct requirements for roosting and foraging habitats, bat communities change when the structural characteristics of the forest landscape patterns are altered (Thomas and West 1988). Data on the distribution and abundance of bats are needed to enable resource managers to make informed decisions about land management (Morrell et al. 1999). Forest age, structure, and management can influence the abundance, diversity, and distribution of species of bats (Erickson and West 1996, Grindal 1996, and Krusic et al. 1996). Recognizing the need to better understand the regional bat fauna, the Klamath Network Inventory and Monitoring (I & M) Program has selected bats as a group of special concern that warrants additional investigation.

Presently little is known about the distribution of bats at CRLA and RNSP. Baseline inventories and assessments of habitat characteristics used by bats are essential for biologists to monitor population trends, evaluate and predict population responses to management activities such as prescribed burning and forest restoration. One study conducted in RNSP (Gellman and Zielinski 1996) indicated that large hollows in trees are important roost sites for bats within the park, although the authors didn't differentiate

between bat species. At ORCA, considerable research has been conducted to determine bat community size, usage patterns, and potential use of acoustical detection within the monument (see Cross 1977, Cross 1997, Whiteman 1997, Cross and Waldien 2002, and Cross and Waldien 2003 for results of these studies).

No studies in CRLA and RNSP have surveyed bats throughout the landscape. Therefore, it is possible that certain species have not yet been identified or have not been properly represented in the population assessments that have been attempted.

Methodology: I conducted systematic surveys using mist nets, harp traps and acoustical sampling. Bats were trapped with live capture techniques throughout the study area at a number of sites including springs, ponds, riparian areas, narrow canyons, streams, and along hiking trails and roads below the forest canopy. Efforts were made to sample bats in areas that represent all major habitat types. The location of capture, species, sex, reproductive status, and age (young vs. adult) of all captured bats was recorded and the bats were released unharmed (Kunz and Kurta 1988). The majority of mist netting occurred between sunset and midnight. The principle investigator was present during all times when mist nets were set.

Acoustic sampling was conducted using AnaBat II echolocation detectors (Titley Inc., Ballina, Australia). Detectors were coupled to an AnaBat compact flash storage ZCA interface module (ZCAIM) and data was recorded directly to compact flash memory cards. Anabat data was subsequently downloaded to a computer's hard disk with the program CFCread, and archived for backup on the KLMN server at Southern Oregon University. During each night of sampling within a study area, AnaBats were placed in 3 habitats and acoustical sampling took place simultaneously throughout the night. One AnaBat was placed within each habitat each night. Each habitat site was sampled for 2 consecutive nights before moving to the next set of habitat types. Species identification was not performed on the preliminary AnaBat dataset, but once the data is collected from the 2005 field seasons, all of this information will be analyzed by a biological technician brought on to the project in 2005.

Park Specific Inventories:

Crater Lake National Park

Mist nets and harp traps were used to capture bats at 8 locations during 11 nights of trapping (1,798.2 m² net hours of netting effort) between 8 and 26 August 2004 in Crater Lake National Park (CRLA). I captured 47 bats representing 5 species in mist nets (Table 1).

Table 1. Capture locations, dates locations were surveyed, and frequencies of captures for 5 species of bats at Crater Lake National Park, 2004.

Capture Location	Dates	Total # Bats	Myyu	Myev	Mylu	Myvo	Lano
Intersection of Sun Creek and Crater Trail	8/8/2004, 8/25/2004	30	6	2	9	11	2
Intersection of Grayback Road and Wheeler Creek	8/9/2004, 8/26/2004	0	0	0	0	0	0
Ponderosa Picnic Area	8/10/2004	0	0	0	0	0	0
Munson Valley	8/11/2004	3	1	0	0	0	2
Off Hwy 62, gravel road NW of Annie Falls	8/12/2004	2	0	2	0	0	0
Small Pool along Castle Crest Wildflower trail	8/15/2004	0	0	0	0	0	0
Small pool at beginning of Annie spring	8/18/2004, 9/1/2004	12	0	6	3	2	1
PCT south of highway at north end of park	8/19/2004	0	0	0	0	0	0

Myyu = Yuma myotis (*Myotis yumanensis*), Myev = Long-eared myotis (*M. evotis*), Mylu = Little brown myotis (*M. lucifugus*), Myvo = Long-legged myotis (*M. volans*), Lano = Silver-haired bat (*Lasionycteris noctivagans*).

Three species represented 76.3% of our mist net captures. Long-legged myotis (*Myotis volans*) was our most frequently captured bat (27.7%) although the species was only captured at 2 sites. Little-brown myotis (*M. lucifugus*) (27.3%) and long-eared myotis (*M. evotis*) (21.3%) were the second and third most frequently captured bat at CRLA. The remaining 23.7% of our captures consisted of Yuma myotis (*M. yumanensis*) (14.9%) and silver-haired bats (*Lasionycteris noctivagans*) (10.6%). At CRLA, 93.9% of our captures were males (Table 2). Females were captured on Sun Creek near Vidae falls and at Annie spring. I was unsuccessful at capturing bats at 4 sites.

Table 2. Frequencies of captures of male and female bats by species in Crater Lake National Park, 2004.

Species	Female	Male	Total
Myyu	0	7	7
Myev	2	8	10
Mylu	0	12	12
Myvo	1	12	13
Lano	0	5	5

Myyu = Yuma myotis (*Myotis yumanensis*), Myev = Long-eared myotis (*M. evotis*), Mylu = Little brown myotis (*M. lucifugus*), Myvo = Long-legged myotis (*M. volans*), Lano = Silver-haired bat (*Lasionycteris noctivagans*).

In addition to live capture techniques, I used AnaBat II detectors to acoustically sample echolocating bats at mist netting locations. AnaBat was also used at 6 sites in each park where live capture techniques were not employed. This facilitated documenting bat presence and activity in areas where mist netting was logistically impossible and it also provides data throughout the night. Overall at CRLA, I recorded 1,240 AnaBat II sequence files (Table 3).

Table 3. Sampling locations, dates locations were surveyed, number of Anabat II sequence files, and mist net deployment at Crater Lake National Park, 2004.

Sampling Location	Date	# AnaBat Files	Site Mist Netted
Intersection of Sun Creek and Crater Trail	8/25/2004	29	Yes
Intersection of Grayback Road and Wheeler Creek	8/9/2004, 8/26/2004	65	Yes
Pondarosa Picnic Area	8/10/2004	68	Yes
Munson Valley	8/11/2004	176	Yes
Off 62, gravel road NW of Annie Falls	8/12/2004	67	Yes
Small Pool along Castle Crest Wildflower trail	8/15/2004	67	Yes
Small pool at beginning of Annie spring	8/18/2004, 9/1/2004	257	Yes
PCT south of highway at north end of park	8/19/2004	13	Yes
Spagnum Bog	8/30/2004, 8/31/2004	78	No
Pumice Desert	8/30/2004, 8/31/2004	66	No
Cloud Cap	8/30/2004, 8/31/2004	56	No
Ponderosa Pine 2	9/1/2004, 9/2/2004	267	No
Pinnacles	9/1/2004, 9/2/2004	26	No
Vidae Cliff	9/1/2004, 9/2/2004	5	No

Oregon Caves National Monument

Mist nets, harp traps, and acoustical sampling were used to survey bats in Oregon Caves National Monument (ORCA) between 7 and 16 September 2004. Our primary objective at ORCA (at the request of John Roth) was to survey 2 cave entrances (monument deep and high hopes) with mock gates present and absent to determine if gating the openings would affect bat activity. I also used a tarp at the 110 cave entrance to determine if restoring natural air flow to the opening would affect bat activity. Tarps were deployed so that approximately ½ of bat gate was covered to mimic the natural entrance dimensions of the opening before it was expanded for an entrance/exit to the cave system. In addition to the acoustical surveys, mist nets were used to capture bats at 1 location and harp traps at 2 locations during 3 nights of trapping at ORCA. I captured 5 bats representing 4 species (Table 4).

Table 4. Capture locations, dates, locations were surveyed, and frequencies of captures for 4 species of bats at Oregon Caves National Monument, 2004.

Capture Location	Dates	Total # Bats	Myca	Myev	Myth	Coto
Gate at 110 exit	9/15/2004	4	0	2	1	1
Main cave tour entrance	9/14/2004	1	1	0	0	0

Myca = California myotis (*Myotis californicus*), Myev = Long-eared myotis (*M. evotis*), Myth = Fringed myotis (*M. thysanodes*), and Coto = Townsend's big eared bat (*Corynorhinus townsendii*).

Two sites, monument deep and high hopes, were acoustically surveyed on 7 and 8 September with mock gates present (obstructed), and on 9, 10, and 13 September with mock gates absent (non-obstructed) (Table 5). At monument deep, an average of 32.5 AnaBat sequence files were recorded at the gated opening and an average of 35.3 were recorded non-gated. At high hopes an average of 30 sequence files were recorded gated

and 12.5 sequence files non-gated (our non-gated estimate is based on 2 nights due to detector malfunction). Additionally, at the 110 cave entrance, 87 sequence files were recorded without the tarp deployed, and 80 sequence files were recorded with a tarp covering approximately ½ of the bat-friendly gate. In this preliminary survey, I noted no evidence that bat activity would be affected by gates on the cave openings.

Table 5. Survey location, dates locations were surveyed, presence of obstruction, number of Anabat II sequence files, and general notes for mock gate study in Oregon Caves National Monument, 2004.

Survey Location	Date	Cave Entrance Obstructed?	# Anabat Files	Notes
Monument Deep	9/7/2004	Yes	0	With Gate
Monument Deep	9/8/2004	Yes	65	With Gate
Monument Deep	9/9/2004	No	67	Without Gate
Monument Deep	9/10/2004	No	33	Without Gate
Monument Deep	9/13/2004	No	6	Without Gate
High Hopes	9/7/2004	Yes	7	With Gate
High Hopes	9/8/2004	Yes	53	With Gate
High Hopes	9/9/2004	No	25	Without Gate
High Hopes	9/10/2004	No	0	Without Gate, Detector Malfunction
High Hopes	9/13/2004	No	0	Without Gate
110 Entrance	9/13/2004	No	87	Without Tarp
110 Entrance	9/14/2004	Yes	80	With Tarp

Long-eared myotis was our most commonly captured bat (40.0%), followed by Townsend's big eared bat (*Corynorhinus townsendii*) (20.0%), California myotis (*M. californicus*) (20.0%), and Fringed myotis (*M. thysanodes*) (20.0%). At ORCA, 100.0 percent of our captures were males. All of our bat captures came from harp traps, unfortunately I was unsuccessful capturing bats at the upper chalet pond using mist nets during my two attempts.

In addition to our other sampling, I used Anabat II detectors to acoustically sample echolocating bats at 2 sites (in addition to the mock gates and tarp sites), the 110 cave entrance and near the bat houses. At ORCA, a total of 432 AnaBat sequence files were recorded (Table 6).

Table 6. Sampling locations, dates locations were surveyed, number of Anabat II sequence files, and mist net deployment at Oregon Caves National Monument, 2004.

Name	Date	# AnaBat files	Site Mist Netted
Gate at 110 exit	9/7/2004, 9/8/2004, 9/9/2004, 9/10/2004	167	No
Bat houses on service road	9/14/2004	9	No
Monument Deep cave entrance	9/7/2004, 9/8/2004, 9/9/2004, 9/10/2004	171	No
High Hopes cave entrance	9/7/2004, 9/8/2004, 9/9/2004, 9/10/2004	85	No

Redwood National and State Parks

Mist nets were used to capture bats at 11 locations during 12 nights of trapping (3,522.4 m² net hours of netting effort) between 21 September and 13 October 2004 in Redwood National and State Parks (RNSP). I captured 36 bats representing 8 species (Table 7).

Table 7. Capture locations, dates locations were surveyed, and frequencies of captures for 8 species of bats at Redwood National and State Parks, 2004.

Capture Location	Dates	Total # Bats	Myyu	Myca	Myvo	Laci	Lano	Epfu	Coto	Anpa
Small stream outside Stout Grove	9/21/2004, 10/5/04	1	1	0	0	0	0	0	0	0
Mill Creek off trail on Howland Hill Road	9/23/2004	2	1	0	0	0	0	1	0	0
Under bridge at Mill Creek Campground	9/22/2004	0	0	0	0	0	0	0	0	0
Down gated road off Bald Hills, only pond available	9/27/2004	4	0	2	1	0	0	0	0	1
Along Redwood Creek, where the road stops	9/29/2004	3	3	0	0	0	0	0	0	0
Coastal Drive	9/30/2004	0	0	0	0	0	0	0	0	0
Fern Canyon	10/4/2004	1	1	0	0	0	0	0	0	0
Old barn at Lyon's Ranch	10/6/2004	1	0	0	0	0	0	0	1	0
Pool next to Mill Creek campground dumping station	10/7/2004	3	3	0	0	0	0	0	0	0
Under bridge at Lost Man Creek parking area	10/12/2004	17	1	0	0	1	15	0	0	0
Zig Zag #2 to Prairie Creek pool	10/13/2004	4	0	0	0	1	3	0	0	0

Myyu = Yuma myotis (*Myotis yumanensis*), Myca = California myotis (*M. californicus*), Myvo = Long-legged myotis (*M. volans*), Laci = Hoary bat (*Lasiurus cinereus*), Lano = Silver-haired bat (*Lasionycteris noctivagans*), Epfu = Big brown bat (*Eptesicus fuscus*), Coto = Townsend's big eared bat (*Corynorhinus townsendii*), and Anpa = Pallid bat (*Antrozous pallidus*).

Two species represented 77.8% of our mist net captures at RNSP. Silver-haired bats comprised 50.0% of our captures, although the species was only captured at 2 netting sites. Yuma myotis was the second most frequently captured bat (27.8%) and was captured at 6 netting sites. The remaining 22.2% of our captures consisted of 6 species, California myotis (5.6%), Hoary bats (*Lasiurus cinereus*) (5.6%), long-legged myotis (2.8%), big brown bats (*Eptesicus fuscus*) (2.8%), Townsend's big-eared bat (2.8%), and pallid bat (*Antrozous pallidus*) (2.8%). At RNSP, 63.9% of our captures were males. Females were captured at 6 of the 11 locations, Stout grove, Mill creek campground, Redwood Creek, Lost Man Creek, and Zig-zag #2 (Table 8). I was unsuccessful at capturing bats at 2 sites.

Table 8. Frequencies of captures of male and female bats by species in Redwood National and State Parks, 2004.

Species	Female	Male	Total
Myyu	5	5	10
Myca	0	2	2
Myvo	0	1	1
Laci	1	1	2
Lano	6	12	18
Epfu	1	0	1
Coto	0	1	1
Anpa	0	1	1

Myyu = Yuma myotis (*Myotis yumanensis*), Myca = California myotis (*M. californicus*), Myvo = Long-legged myotis (*M. volans*), Laci = Hoary bat (*Lasiurus cinereus*), Lano = Silver-haired bat (*Lasionycteris noctivagans*), Epfu = Big brown bat (*Eptesicus fuscus*), Coto = Townsend's big eared bat (*Corynorhinus townsendii*), and Anpa = Pallid bat (*Antrozous pallidus*).

In addition to live capture techniques I used Anabat II detectors to acoustically sample echolocating bats at mist netting locations and 6 sites where live capture techniques were not used. Overall at RNSP, 4,480 AnaBat sequence files were recorded (Table 9). Additionally, 5 Townsend's big eared bats were visually observed in the northernmost building at the World War II Radar Station on 22 September 2004.

Table 9. Sampling locations, dates locations were surveyed, mist net deployment, and number of Anabat II sequence files recorded in Redwood National and State Parks, 2004.

Sampling Location	Date	Site Mist Netted	# AnaBat Files
Small stream outside Stout Grove	9/21/2004, 10/5/04	Yes	170
Mill Creek off trail on Howland Hill Road	9/23/2004	Yes	30
Under bridge at Mill Creek Campground	9/22/2004	Yes	58
Down gated road off Bald Hills, only pond available	9/27/2004	Yes	228
Along Redwood Creek, where the road stops	9/29/2004	Yes	360
Coastal Drive	9/30/2004	Yes	39
Fern Canyon	10/4/2004	Yes	0
Old barn at Lyon's Ranch	10/6/2004	Yes	0
Pool next to Mill Creek campground dumping station	10/7/2004	Yes	176
Under bridge at Lost Man Creek parking area	10/12/2004	Yes	62
Zig Zag #2 to Prairie Creek pool	10/13/2004	Yes	30
1/4 mile down from Tall Trees trailhead	9/28/2004, 9/29/2004	No	3
Dolason Prairie	9/28/2004, 9/29/2004	No	2
Espa Lagoon	9/28/2004, 9/29/2004	No	54
Through the gate on Camp Klamath road	10/12/2004, 10/13/2004	No	10
Lagoon Creek	10/12/2004, 10/13/2004	No	2428
Facing old SOC buildings	10/12/2004, 10/13/2004	No	830

Summary: During the summer of 2004, bat inventories were conducted in three of the Klamath Network (KLMN) parks: Crater Lake National Park (CRLA), Oregon Caves National Monument (ORCA), and Redwood National and State Parks (RNSP). Five species were documented in CRLA using live capture techniques, 4 species in ORCA, and 8 species in RNSP which resulted in a grand total of 90 captures representing 11 species in KLMN. In addition to the live captures, I recorded 6,152 Anabat II sequence files during echolocation surveys. In this preliminary survey, I noted no evidence that bat activity would be affected by bat friendly gates on the cave openings at ORCA.

Unfortunately, no new species were documented in KLMN that were not already listed on uncertified park species lists, but I did confirm the documentation of 11 species in KLMN for these lists. This is most likely due to the fact that survey effort (5,231 m² net hours) during this field season is only about 10% of that conducted for Lassen Volcanic National Park and Whiskeytown National Recreation Area during equivalent surveys conducted during the summers of 2001-2003. Due to the fact that bat presence and relative abundance can vary greatly at sites, management implications should not be drawn from this preliminary data set. Almost certainly, additional species will be documented in subsequent surveys at CRLA and RNSP during summer 2005 and in depth species-specific AnaBat analysis may reveal additional species as well. The results of this preliminary survey should be interpreted with caution until additional survey data is available. On 1 June 2005, the second field season of this study will begin in CRLA (see calendar following this section for more information).

Calendar:

- 1 June 2005: Technician begins second season of AnaBat data collection at CRLA and RNSP
- 13 June 2005: Principle investigator begins live trapping at CRLA
- 11 July 2005: Principle investigator begins live trapping at RNSP
- 1 September 2005 – 28 February 2006: Species specific predictive occurrence model development and mapping, web dissemination, and preparation of final report
- 28 February – 31 March 2006: Draft report review period
- 31 March – 15 April 2006: Final editing period
- 30 April 2006: Final report submitted to the Klamath Network I & M Program

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